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REPORT OF

Twenty-Ninth Annual

DATE GROWERS' INSTITUTE

APRIL 26, 1952



HELD IN

COACHELLA VALLEY

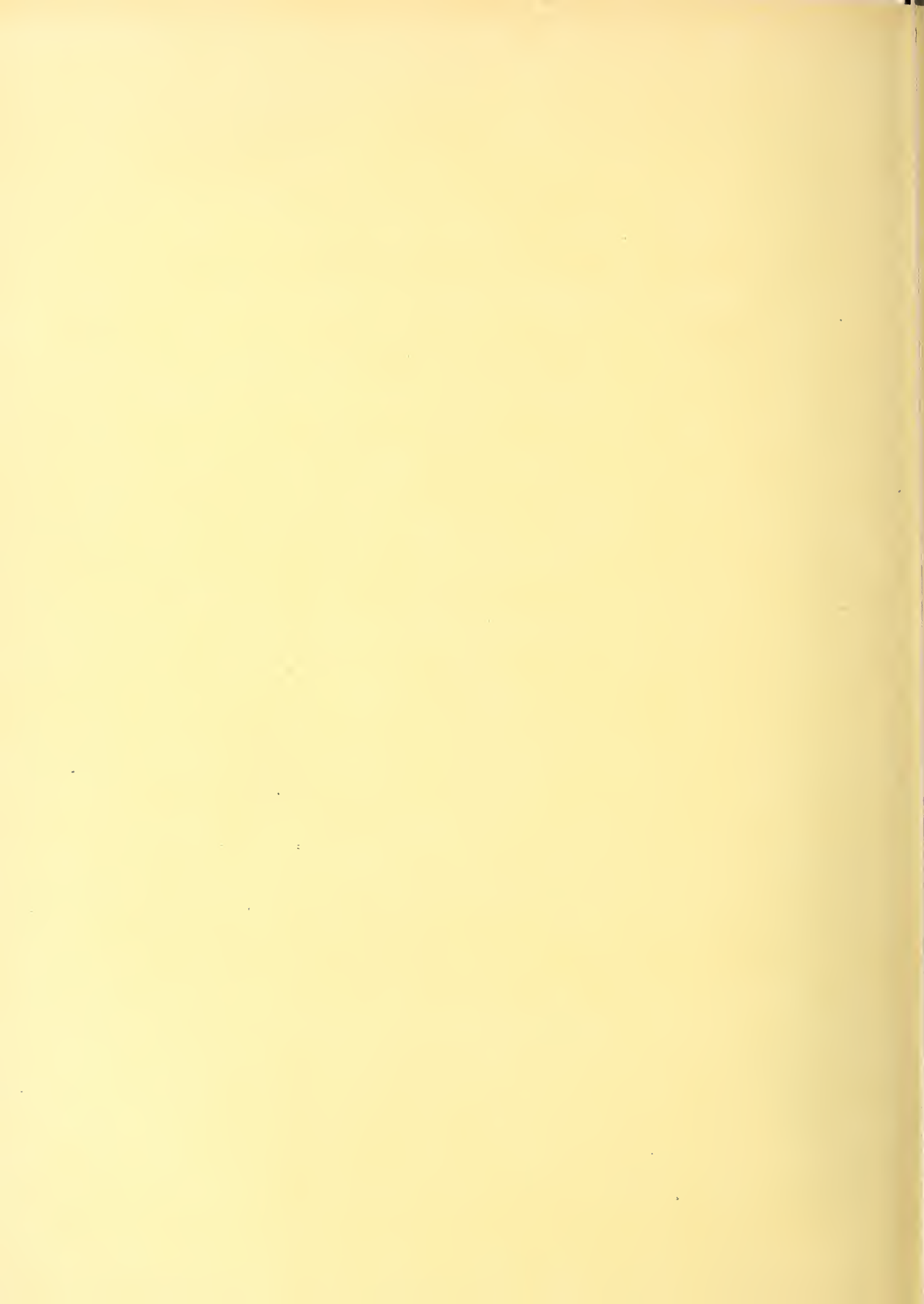
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CHANDLER, ARTHUR H. COOK

S. W. COOK, L. A. COOK

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Twenty-Ninth Annual DATE GROWERS' INSTITUTE

**HELD IN
COACHELLA VALLEY
CALIFORNIA**

APRIL 26, 1952

VOLUME 29

CHAIRMAN MORNING SESSION
A. M. Boyce

CHAIRMAN AFTERNOON SESSION
Frank A. Thackery

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29th Annual Date Growers' Institute

April 26, 1952

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Formerly with U. S. Date Garden, Indio

SUGARS IN THE FRUIT OF SOFT, SEMI-DRY, AND DRY COMMERCIAL DATE VARIETIES

By James A. Cook and J. R. Furr¹
U. S. Date Garden, Indio, California

Soon after the date industry was established in this country it was recognized that date varieties could be divided into two chemically different types — one in which invert sugars predominate and the other in which relatively large amounts of sucrose, or cane sugar, are present. The U. S. Date Garden occasionally receives from persons concerned with the use of dates in special diets requests for information regarding the invert and cane sugar contents of particular varieties. Efforts to find this information disclosed that sugar analyses were recorded for only a few of the most important American-grown varieties of dates. It has heretofore been rather generally assumed that soft dates are invert-sugar varieties and that dry and semi-dry dates contain relatively large amounts of cane sugar. However, this assumption has been based on rather limited analytical data.

In the planning of proposed date breeding work, one of the things in which we are interested is the relation of the texture, or firmness, of fruit to the proportions of cane and invert sugars in the cured fruit. To obtain information on a large number of varieties and to determine relations or trends as definitely as possible, we collected 51 different sorts for analysis.² The full report on these varieties is presented elsewhere (1). In the present paper analyses are given only for the varieties (except Iteema) that Nixon (4) listed as being of commercial importance.

MATERIALS AND METHODS

Tree-ripe fruit samples were collected during the harvest season of 1947. Since the season extended over

a period of about two months, the various varieties were not all subjected to the same storage conditions. In general, the lapse of time between harvesting and preserving in alcohol varied from a few days to over a month. During this time most of the dates were stored at 39 to 43° F. in domestic refrigerators, although some of the samples were placed in a freezing locker within a week after picking and remained there for about four months before being preserved in alcohol.

Twenty-five fruits were taken as a sample. The fruits were deseeded, ground in a food chopper, and mixed. A 5-gram sample was weighed and immediately dropped into hot 80% alcohol. Dry weight was determined by drying in a vacuum oven the residue and an aliquot of the extract to constant weight at 65° F. Invert sugars were determined by the ferricyanide-ceric sulfate method described by Hassid (2, 3). Total sugars were run in the same manner after inversion with invertase. Cane

sugar content was then determined by difference between total sugars and invert sugars.

RESULTS

The moisture content, the invert sugars, the cane sugar, and the total sugar content of the major varieties are presented in table 1. The moisture value is, in each case, expressed as a percentage of the fresh weight of the sample, whereas the sugar values are given on a percentage dry-weight basis. The varieties are grouped according to the texture or consistency classification characteristic of the variety as described by Nixon (4) rather than according to the consistency of the particular sample at the time it was being prepared for analysis.

DISCUSSION OF RESULTS

Data for all 51 varieties (1) indicate that, in general, degree of firmness of cured fruit is related to sugar composition; that is, that invert-sugar varieties are soft dates and that those containing considerable quantities of

Table 1. Moisture, reducing sugars, sucrose, and total sugar contents in stored samples of some soft, semi-dry, and dry varieties of dates.

Variety	Moisture (fresh-weight basis) %	Total sugar (dry-weight basis) %	Reducing sugars (dry-weight basis) %	Sucrose* (dry-weight basis) %
Soft varieties				
Barhee	37.3	84.8	84.8	0
Halawy	14.9	81.8	81.8	0
Hayany	12.8	78.7	75.7	3.0
Khadrawy	24.4	82.2	82.2	0
Khalasa	30.7	78.7	78.7	0
Kustawy	16.9	80.7	80.7	0
Maktoom	27.4	77.0	77.0	0
Medjool	21.3	76.8	76.8	0
Rhars	13.6	77.5	77.5	0
Saidy	14.9	80.7	77.3	3.4
Sayer	16.9	74.5	74.5	0
Tazizoot	26.0	76.5	76.5	0
Semi-dry varieties				
Dayri	22.2	75.7	70.4	5.3
Deglet Noor	24.1	77.1	38.6	38.5
Zahidi	13.6	78.2	70.7	7.5
Dry variety				
Thooray	15.5	73.0	40.9	32.1

*Sucrose by difference between total and reducing sugars.

1. Associate horticulturist and senior horticulturist, respectively, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

2. Samples of a number of these varieties and their identifications were supplied by R. W. Nixon, who was making a collection for another purpose.

cane sugar are the firmer, drier types. There are a few striking exceptions, but most of these are in varieties of very minor importance in this country. Although the Dayri and the Zahidi are shown in table 1 as having appreciable amounts of cane sugar, one might expect a much higher level in these semi-dry types. Also the dry Thoory is listed as having less cane sugar than the semi-dry Deglet Noor, but only two of the soft dates show measurable amounts of cane sugar.

Vinson (6) presented data indicating that probably in all date varieties cane sugar comprises a high proportion of the total sugars at some stage in the fruit development. Rygg (5) found that the course of changes in proportions of invert sugars and sucrose during fruit development was similar in both types of dates until the beginning of ripening. During ripening, inversion of sucrose to invert sugars is rapid in the invert-sugar dates and apparently nearly complete in many varieties. In the cane-sugar type, however, it is slower and may often be arrested or inhibited by rapid drying of the fruit.

In the Deglet Noor, and undoubtedly in similar varieties, the percentage of invert sugars depends on a number of factors such as the environmental conditions under which the fruit was grown and ripened, the degree of maturity at the time it was picked, its water content, and the storage conditions. Therefore, within a given cane-sugar variety one may

find a wide range in the proportion of invert sugars present. For example, an examination of the literature shows invert-sugar values ranging from about 13% to as high as 38% for unprocessed Deglet Noor dates.

That so many factors can so markedly affect the level of invert sugars in those varieties in which it is not the predominant sugar must be kept in mind when one examines the data in table 1. It must not be assumed that these data represent the proportions of invert and cane sugars to be found in fresh samples, but rather they are representative of stored fruit of these varieties, with the values for invert sugars being generally of the magnitude to be expected in a given variety.

Total sugars, on the other hand, show much less variability — less among the major varieties than invert sugars often do within a single variety. Table 1 shows a range from 73.0% for Thoory to 84.8% for Barhee, and there seems to be no relation whatever between these values and the texture grouping. It may be that there are consistent differences in total sugar content among these varieties, but if so, they would be so small as to be of no importance.

SUMMARY

The moisture content, invert sugars, cane sugar, and total sugar percentages are given for stored samples of commercial date varieties. Analyses of fruit samples from a larger number of varieties indicate that texture,

or degree of firmness, is related to the proportions of invert and cane sugars present. Soft dates contain very little cane sugar, the intermediate or semi-dry dates have considerable amounts, and the dry dates have as much as or more than the latter. Although invert-sugar values for the intermediate and dry types can be markedly affected by a number of factors, total sugar values among the three groups are quite similar. The extremes for the varieties listed were 73.0% for Thoory and 84.8% for Barhee.

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REPORT ON DATE FRUIT SPOILAGE

E. F. Darley, D. L. Lindgren, L. E. Vincent, and W. D. Wilbur

University of California, Citrus Experiment Station, Riverside, California

Experiments on the control of fungus and insect spoilage of date fruit were continued during the 1951 fruit season.

Plots were set up in three date gardens. Gardens No. 1 and No. 2 were located near Indio, and garden No. 3 near Thermal.

FUNGUS SPOILAGE

Experiments over the past several years, which have been published in these reports, have shown that fungus spoilage is partially controlled by good fruit-bunch management in the use of paper bags to protect the fruit from rain, inserting wire rings to spread the strands and promote aeration, and dusting with fungicides to inhibit the growth of fungi. These treatments, which included applications of two fungicides, were again applied in various combinations to each of six bunches of Deglet Noor fruit in gardens No. 1 and No. 2.

The paper bag selected was the brown Kraft type receiving a higher-than-normal rosin size treatment plus

the Melamine wet-strength treatment but no wax. This cover was recommended after two years' test as being better than the then commercial waxed brown paper bag. The fungicides used were Thiomate "19" and 5 per cent dehydroacetic acid in sulfur.

The experimental bunches were dusted on July 19, July 31, and August 22, supplied with rings on July 19, and bagged on August 1 at garden No. 1, and on August 22 at garden No. 2. The dusting on July 31

was extra and seemed to be necessary because rain on July 28 had washed off some of the fungicides. Beginning the first week in October, ripe fruit was picked each 2 to 3 weeks and the amount of spoilage noted. The treatments applied and results obtained are shown in table 1. Fungus spoilage in control bunches receiving paper bags only was not severe, in spite of the rains on July 28 and August 28. However, even with this relatively low amount, spoilage was reduced in all bunches receiving

Table 1. Effect of paper bag, wire ring, and two fungicides on the control of fruit spoilage in Deglet Noor dates, 1951.

Treatment	Per cent of infected fruit	
	Garden No. 1	Garden No. 2
Paper bag only (control)	9.0	9.4
Paper bag, ring	13.6	8.1
Paper bag, Thiomate "19"	3.1	2.7
Paper bag, dehydroacetic acid	4.3	2.3
Paper bag, ring, Thiomate "19"	2.3	0.6*
Paper bag, ring, dehydroacetic acid	5.0	2.0

*Significant at the 5 per cent level.

fungicides, although in only one case was this reduction statistically significant. Thiomate "19" appeared to be a little better fungicide than dehydroacetic acid. The best control of fungus spoilage appears to be achieved through the combined use of paper bags, wire rings, and Thiomate "19."

INSECT INFESTATION

During the 1951 season, the infestation of dates by nitidulid beetles varied considerably. In a single Khadrawi garden as much as 15.8 per cent of the fruit was infested. The range of infestation in several Deglet Noor gardens in which experiments were conducted varied from 2.9 per cent to 39 per cent infested fruits. This variance in infestation may be due to several factors. Those gardens having a high degree of fruit spoilage were ideal for beetle development. Gardens in which the dates matured late showed little or no infestation, especially those gardens in which the first picking did not occur until sometime after October 1. It is our observation that as the weather becomes cooler, the activity of the beetles is much reduced. Those dates on the dry side, although not infested with dried fruit beetles, became infested with moths (*Ephestia figulilella*).

A 2 per cent parathion dust was applied in gardens No. 1 and No. 3 on September 18, and in garden No. 2 on September 11. In all three gardens the bunches were covered with paper bags prior to dusting, and the first pickings were made two to three weeks after the application of the dust.

It will be noticed from table 2 that the degree of infestation was reduced from 2.9 per cent to 0.1;

Table 2. Results of the application of a 2 per cent parathion dust on insect infestation in Deglet Noor dates, 1951.

Garden	Live	Dead	Total	Per cent infested fruit
No. 1				
Control	346	9	355	2.9
2% parathion	0	2	2	0.1
No. 2				
Control	4031	159	4190	13.1
2% parathion	2	26	28	0.7
No. 3				
Control	937	0	937	39.0
2% parathion	6	328	334	12.0

13.1 per cent to 0.7; and 39 per cent to 12 in gardens No. 1, No. 2, and No. 3, respectively, by the use of a 2 per cent parathion dust. A total of 5,314 live beetles were found in the untreated bunches, and a total of 8 live beetles in the bunches treated with 2 per cent parathion.

In garden No. 3, 12 per cent infested fruit was found in the treated plot; this indicates that the parathion dust should have been applied earlier than the 18th of September. In this particular instance the dust was applied after the infestation was already present.

Of all the insecticides that have been tested for controlling the nitidulid beetles, parathion, gamma isomer of benzene hexachloride, dieldrin, aldrin, and chlordane readily kill these beetles upon contact. Previous work has indicated that benzene hexachloride and chlordane occasionally may impart off-flavor to the dates, therefore these two materials could not be used.

Available information at the present time indicates that aldrin, dieldrin, and parathion are toxic to warm-blooded animals, which makes the application of these materials hazardous.

Residue analyses of parathion for the past three years (1949-1951) indicate that with dust applications applied 3 weeks prior to the first picking, the present packing-house washing operations reduce the parathion residue below the suggested tolerance. No methods have been available for testing residues of aldrin and dieldrin.

Seven new materials and sulfur were tested against the date mite. The effectiveness of these acaricides when applied as dusts (with the exception of Systox, which was applied as a spray) was as follows:

ACARICIDE	NO. OF DAYS EFFECTIVE
5% 4049	0
5% R242	0
5% Thiocide	0
5% Thiocide G	0
5% EPN	0
5% MR-30	0
Systox	0
(1 pt./100 gal. water)	
Sulfur	42

None of the materials approached the control obtained with sulfur when properly applied to the date bunch. For the most effective control of the date mite, sulfur should be applied before the mite has produced extensive webbing, and a thorough coverage of the dates in the bunch is essential.

DATE PRODUCTS INVESTIGATIONS

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Food Technology Division, University of California, Berkeley

According to Varden Fuller of the University of California, 1951, Americans use about four-tenths of a pound of dates per capita per year. About one-half of this is supplied from domestic production and about one-half by imports, principally from Iraq and Iran (Persia). In spite of this very small per capita consumption of dates there have been marketing difficulties and poor returns to growers in most years since the close of World War II, according to Fuller. Production has increased greatly over the past thirty-five years; from about

60,000 pounds in 1917 to over 30,000,000 pounds in 1948 and in 1951, according to the 1949-50 report of the Date Advisory Board and to Dr. Fuller. According to Fuller, 1952, consumption of California dates is much higher per capita in the Pacific Coast States than East of the Rockies. Also, he states that at present California dates are sold chiefly during the winter holiday period. His data indicate that about three-fourths of the population do not buy dates, or at most buy very few. If the War years are excluded, imports have var-

ied from 20,504,000 pounds in 1947 to 55,972,000 pounds in 1937. Fuller states that of the fruit delivered to packing houses from 2 to 20 per cent, depending on the season, is unfit for human consumption and that from 10 to 35 per cent is sub-standard in quality, not merchantable as whole fruit. Much of the fruit suitable for packing in whole condition required processing to improve its appearance and moisture content. Some who have studied the industry feel that some of this Grade C or Standard grade now packed as whole dates

Acknowledgments: The authors are greatly indebted to W. H. Tappan for funds provided for these investigations, and to the Associated Date Growers and Packers and the California Date Growers Association for generous supplies of dates and date products for use in our experiments. We wish also to thank Frank H. Winter for many helpful suggestions, and to thank Mary Ng, George Yip, E. Meyers and R. Maass for valuable assistance in the laboratory.

should be utilized in other forms. Grade C amounted to 17,203,518 pounds in the 1949-1950 season.

From time to time requests have been made that the University conduct studies on the preparation of new products and of improved present products for the purpose of finding more profitable outlets for the Sub-standard dates and for some of the Grade C dates. The present report is based largely on experiments made possible by a research fund established by W. H. Tappan, who is a well known manufacturer and friend of the date industry.

On display at this meeting are a considerable number of date products made experimentally. Several will be available for sampling after presentation of this paper.

THE SUPPLY PROBLEM: Since the tonnage of dates for use in products is not large in comparison with raisins or prunes, the question arises "if a very successful date product were discovered and developed would there be enough dates to supply the demand for the product?" Frank Winter, Varden Fuller and others have pointed out that rather disturbing question.

PRODUCTS DEVELOPED BY THE INDUSTRY: We wish merely to report our results, show the samples and let you draw your own conclusions. We do not recommend that anyone undertake to produce any of these products commercially. On the other hand, perhaps one, two or three of them are worthy of small or pilot scale trial merely to see if it or they show any promise.

And, also we wish to pay tribute to the growers, processors and others in the industry who have done so much to discover, develop and market date products. Several of these are very successful.

In fact, as one processor put it, "We have tried here in the Valley about every conceivable product that can be made from dates," and I do not think he was kidding.

DATE BEVERAGES: We shall discuss our experimental date beverages first, since we believe that at least one of them shows some promise.

Coachella Valley produces a large quantity of excellent grapefruit of which a considerable proportion is available for juice production since it shows minor defects in appearance which make it unsuitable for packing for fresh sale.

We have found that dates can be readily extracted to give a "juice" (water extract of dates); and that a blend of date "juice" and grapefruit juice makes a pleasing and healthful beverage. The dates were extracted at 140-160° F. by the diffusion battery procedure with four extractors (large jars in our experiments) in series. Thus, each lot of dates is

extracted four times. Quality of the juice is much better when extracted at 140-150° F. than at 212° F. For blending with the grapefruit juice it need not be clear as grapefruit juice is cloudy. We found that the date juice should be of about 20° Brix. A 50:50 blend of the two juices was preferred to other ratios of the two.

The blend was canned and pasteurized by standard procedure.

The date juice is low in acid and, therefore, "cuts" the tartness of the grapefruit juice. The grapefruit-date juice blend was preferred to one of Valencia orange juice and date or of lemon juice and date or apple and date or of grape and date. Straight date juice, either plain or acidified was not pleasing.

Since dates and grapefruit are easily transported the juice could be produced in existing citrus juice plants, such as those in Santa Ana, Anaheim, Ontario and elsewhere.

A date nectar was made of sieved dates and grapefruit juice. While of pleasing flavor the nectar was unattractive in appearance and "gritty" on the palate.

Not that we think they have very great possibilities, but we made table wines, sweet wines of Angelica type and brandy out of sub-standard dates and also out of the syrup and pulp adhering to date pits from an Elliott date pitting machine. The Angelica might have possibilities.

VACUUM DRIED PIECES AND POWDER: We produced "bone dry" broken pieces of natural date color by dehydrating pitted dates under high vacuum in the large laboratory or pilot size vacuum dehydrator of the Vacu-Dry Corporation in Oakland; followed by crushing and screening. These pieces contained less than 1 per cent of moisture and were slightly porous, rather than dense and hard. One can eat them as candy. They refresh quickly in water, milk or other liquids, hence are excellent for use in bread, rolls, muffins, cakes, candies, etc. Drying in vacuum is very rapid; complete in less than four hours.

The fines from crushing and screening are also pale in color, of excellent flavor and useful in shakes, cookies, cakes, etc. Both products, of course, must be packed in moisture-proof containers.

In one experiment whole unpitted dates were dried in vacuum, crushed and screened to separate the pits from the pieces.

In several experiments pitted dates were dried on trays in an air blast dehydrator at 150-160° F. More than 48 hours drying was required to make them dry enough to crush and screen and the dried pieces were dark in color, very hard and dense

and caramelized in flavor. Vacuum drying gives a superior product.

FREE FLOWING POWDER: Finely ground or powdered vacuum dried dates take up moisture rapidly from the air and thereby become caked. We found that mixing of the powder with about 25 per cent of powdered sugar gave a product that remained free flowing under Berkeley atmospheric conditions. It is useful in frostings, cake fillings, milk shakes, ice cream making, baked products, etc. Similar powders were made of powdered dates, powdered sugar and finely ground almonds or walnuts; useful in frostings, shakes, baking, etc.

DATE-MALTED-MILK-POWDER: Powdered vacuum dried dates were mixed with Borden's malted milk powder on a 50:50 basis. It keeps well and makes a pleasing malted milk when whipped up in whole, fresh milk.

DATE CANDIES: Dates in various forms "work out" very well in candies. We have made a number of different types of date candies ranging from an all-date (100 per cent date) candy consisting of ground pitted dates and date syrup, to such candies as fudge, divinity, panache and jelly candies containing from 25 to 50 per cent or more of dates. Milk chocolate and confectioners white coating were melted and used as binders for ground or chopped dates of fairly low moisture content to give excellent candies of 75 per cent or more date content. They can be made in the form of 5 or 10 cent date bars, as well as in smaller pieces for packaging as regular candy.

Formulas for various fruit candies are given in our Circular 175, "Home Made Fruit Candies," copies of which are available free at this meeting, or from the College of Agriculture, Berkeley, California. Consequently, we shall not give detailed formulas here. In using the circular merely use dates instead of other dried fruits in the various recipes. We shall be glad to give additional details on request.

Americans consume nearly 20 pounds of commercially produced candy per capita per year or more than 40 times as much candy as of dates. Since dates are very satisfactory in candies there may be an important untapped market for dates to be used in commercial and in home made candies.

DATES IN 5 AND 10 CENT BAGS: More than half of all candy sold in the U. S. A. is in the form of 5 cent and 10 cent bars. Much, perhaps most of these, are bought by school children as between meal snacks.

Dates make an ideal raw material for that purpose. Recently, one of our young graduates, Mrs. Betty Carl, now a mother, wrote to suggest that dates preferably pitted and

packed in small plastic bags for sale for 5 cents and 10 cents a bag might prove popular with school children. The dates would not only be a tasty form of candy but would be a nutritious and healthful snack as well.

We packed pitted dates and also date rings as she suggested and mailed several bags to her. She reported that her youngsters ate the dates and rings with great enthusiasm and clamored for more. She may have started something very important with this suggestion; for not only children but adults as well like dates and if they were to be found conveniently and attractively displayed in cigar stores, on candy counters, on restaurant counters and near grocery store cash registers there might be a very brisk demand for them. It is an idea that could be tried out at not very great expense.

The date rings are especially suitable for such packaging. In that connection we find that when we are working with date rings in the laboratory, students eat them with real gusto and in self defense we have to hide them.

SYRUPS: Table syrup consumption in the U. S. A. is very heavy; over 200,000,000 gallons per year. Dates were extracted by leaching in hot water in a four stage battery to give a juice of about 20° Brix. This was treated with a pectic enzyme to remove pectin and thus improve filtration. The filtered juice was concentrated in vacuum at not above 120° F. to give a clear, amber colored syrup of 68-70° Brix. It was mild in flavor; but pleasing as a table syrup and was useful in cooking. Samples are on display and for tasting.

Some of the juice was treated with ion exchange resins similar to those used in water softening units. These removed all of the mineral constituents, color and fruit acids leaving a colorless neutral juice. On vacuum concentration a clear, water-white, colorless syrup was obtained suitable for use as a sugar substitute in baking, canning, candy making, etc. There seems to be no occasion for making such a syrup since sugar is plentiful and of moderate price. We made the experiment merely to see how date juice would respond to this process.

JAMS AND PRESERVES: Sieved date jams and preserves are popular in Egypt where we sampled them in 1939. Sieved dates and macerated dates were made into jams in various ways. Blends of date and pineapple and of date and apricot were quite satisfactory. Straight, unflavored date jams acidified with citric acid or lemon juice were pleasing but less popular with the taste panel

than were the pineapple-date and apricot-date jams.

Spiced date jams and butters were quite pleasing and preferred to the unspiced.

Preserves were made of sliced dates, water and sugar. Addition of citric acid or lemon juice greatly improved them.

WHY ACIDIFY DATE PRODUCTS: Dates are extremely low in acid and hence very difficult to sterilize by heating in the form of purees, canned dates, etc. Also lack of tartness (acid) causes them to satisfy one's appetite for dates too soon. Because of their low acidity Botulinus poisoning (fatal) could develop in insufficiently sterilized canned date products if not acidified. For these reasons we acidified our canned products.

CANNED PRODUCTS: Pitted dates and the unpitted were canned in plain syrups, and also in a spiced vinegar syrup as "pickled dates." These latter might find some favor for serving as an appetizer or for use in mixed salads.

Rings were canned in acidified syrup for use as a dessert. Rings and also cut pitted dates were canned with apple and without apple for use as pie fillings in a syrup thickened with starch. Date-apple pie was satisfactory.

Macerated (Elliott pitted) dates were canned very successfully and give the housewife and baker dates in a very convenient form for use in cakes, cookies, puddings, etc. The product keeps perfectly as it is sterilized.

SIEVED DATE MILK SHAKE BASE: Sieved dates were prepared by heating the fruit in sufficient water to reduce the soluble solids content to 40 per cent; allowed to stand overnight to absorb the water; sieved in a tomato pulper; acidified slightly; canned hot, sealed and sterilized. This product was very satisfactory in milk shakes, ice cream making, in puddings, and in baked products.

It is easily measured for use in milk shakes or in other ways, as it is soft in texture, not stiff. See next paragraph.

INTENSIFYING DATE FLAVOR AND COLORS We all hate to admit it, but dates and also sieved date meat are mild in flavor and pale in color. The sieved is "pale" in both properties.

We have found that it behaves somewhat like maple sap on heating. Maple sap develops the well known maple syrup flavor during the boiling down process. Similarly, if dates or sieved dates are heated at 200-212° F. for 60 minutes or longer their flavor is greatly intensified and the color is reddened. Sieved date so treated imparts a rich flavor and color to milk shakes and ice cream. Our taste

panel preferred it to the unheated in milk shakes and ice cream.

DATE NUT BAR BASES: Some small bakeries feature (or used to in Berkeley) date-nut bars made of chopped or ground dates, eggs, flour, chopped nuts (usually walnuts) and sugar. We have prepared and canned a mixture of macerated dates and nuts and also have made mixtures of powdered dates, sugar, vacuum dried date pieces and chopped nuts for packaging in cellophane or pliofilm bags for household use in preparing date-nut bars. We believe that date-nut bars would, if properly promoted, prove popular items in bakeries; also that housewives would make them if dates in easily used form were available.

IN BREAKFAST CEREALS: The vacuum dried date pieces were packaged with several kinds of to-be-cooked, cereals such as Cream of Wheat, Rolled Oats and "Zoom." On cooking with the cereals the date pieces softened and imparted a fruity appearance and flavor to the cooked cereal. Date rings cooked up very well in rolled oats and Cream of Wheat.

The dried date pieces were also added to packaged ready to serve cereals including Grape Nuts, Grape Nut Flakes and Corn Flakes.

Flakes were made by mixing sieved dates with whole wheat flour, bran and a leavening agent to give a stiff dough. This was mechanically cut into pellets, partially dried and then the pellets were flaked on a small scale by pressure between smooth steel plates. The flakes were then dried and toasted giving a date flake cereal of more than 50 per cent date. Similarly a shredded cereal was made. Figs and prunes were made into flakes in similar fashion except that the pellets were flaked between small commercial type hot rolls as in making Corn Flakes. Dates could be used in the same manner.

Since the breakfast cereal market is such a large one and the date supply so limited perhaps all that need be done might be to suggest to housewives that they add date rings or chopped dates to cereals. That suggestion might "use up" a lot of dates.

DATE NUT TOPPING FOR DATE SUNDAES: Coarsely ground dates, acidified syrup and chopped nuts were mixed and canned to give a tasty topping for ice cream. It would be used on ice cream as is strawberry sundae topping.

PRE - MIXED CAKE AND OTHER FLOURS: Dates in vacuum dried pieces and granular powder form were added to pre-mixed cake flour, muffin flour, biscuit flour and cookie flour. Cakes, cookies, muffins and biscuits made from them were very attractive in appearance and of pleas-

ing flavor. Such products might find favor with many housewives if some large ready mix flour company such as General Mills would produce and promote them. Hills Bros. pack commercially a package of pre-mixed muffin flour in which is packed a plastic bag of chopped dates. We believe addition of vacuum dried pieces "right with the flour" would be preferable.

PUDDING BASES: Mixtures of starch, sugar, vacuum dried date pieces or vacuum dried "granular powder" gave attractive looking puddings on cooking. They could be packaged as is Jello, Amazo, Jellwell and other well known dessert bases.

In fact, we have packed the vacuum dried pieces or powder with Amazo and with Jellwell and have found that very pleasing desserts and open face pie fillings can be made by following the Amazo and Jellwell directions.

ICE CREAM BASES: Date ice cream is a very good product; not as flavorful as strawberry or vanilla, but nevertheless quite satisfactory. We have prepared a package for home use containing an 8 oz. can of sieved dates of 40 per cent solids and a cellophane bag containing the necessary gelatin and sugar. The user would dissolve the sugar and gelatin in a pint of scalded milk, cool until it jells, whip thoroughly, add the sieved date and a pint of whipping cream and freeze.

We also packed a mixture of powdered dates, sugar and gelatin in plastic bags for use in making date ice cream about as outlined above. Housewives already use commercially made home ice cream preparations and a date ice cream base might interest them.

A "Froste" base could be made if desired; and a date sherbet base also could be prepared.

PITTED DATES IN WINE AND BRANDY: Brandied dates are an old story and are on the market. Demand is very limited. Pitted dates in Muscatel and in Sherry, we found, developed a pleasing flavor for those who use such wines. We merely packed the pitted dates in jars in these wines and allowed them to stand several weeks.

JAM BASES: The canned macerated dates and canned sieved dates are satisfactory for making jams in the home. Merely add sugar, water and a little lemon juice and cook as in the making of any fruit jam.

DATE FUDGE MIX: Powdered dates and vacuum dried pieces worked quite well in commercially made packaged powdered fudge base for home use.

IN COMMERCIAL COOKIES AND CRACKERS: To commercial cookie and cracker doughs from an Oakland factory were added vacuum dried date pieces in some cases and in others granular date powder. Date cookies and crackers were baked from them quite successfully. Also a filling for date Newtons was prepared and Newtons made with it.

See also the section on pre-mixed flours for cakes, cookies, etc. Large producers of crackers and cookies might be induced to use dates in certain of their products.

FLAVORED DRY DATES: Dates in comparison with other dried fruits are very low in acid; hence they satisfy too quickly. If one eats his fill of dates he may not want to eat dates again for a long time. At least that is our experience.

We acidified pitted dates by heating

them at 140° F. in a syrup of 50° Brix, acidified with 0.5 per cent citric acid and setting aside overnight. They were then drained, rinsed in water to remove the outer layer of syrup and were dehydrated at 140-150° F. to about 20 per cent moisture content. They were then rolled in sugar to overcome stickiness. They had a sprightly (mild-tart) flavor and pleasing appearance.

Others were similarly treated in an acidified syrup flavored with cinnamon, draining, rinsing and drying. Most of us liked them also, but preferred the acidified unflavored sample.

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A FEW NOTES ON THE MEDJOOL DATE DURING ITS ISOLATION IN NEVADA

By Frank A. Thackery¹

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I am indeed grateful for the invitation to meet with you on this occasion and to have the honor of presiding at this afternoon session of your 29th Annual Date Growers' Institute. It is a real pleasure to meet with old friends and to have this opportunity to make new ones.

I was appointed to have charge of the U. S. Date Garden, Indio, March 20, 1922. I retired from government service about eighteen years later on June 30, 1940. During an extended Federal service of almost fifty years I had varied experience in many western states. This placed me in close contact with the extremes of

climate, soil, water and growing conditions. From that long experience I want to say to you that in no state did I find better soil, better water or better growing conditions than you have in this date-growing area.

The main purpose of this short paper is to record a few of my observations and experiences concerning the Medjool variety of date which was under my care during the first seven years following its importation from Morocco. It is my understanding that this date is giving some promise of commercial importance in Coachella Valley.

In the Report of the Annual Date Growers' Institute for April 28, 1945, Dr. Walter T. Swingle gave an ex-

cellent account of his importation of eleven Medjool offshoots from southern Morocco in Africa. They arrived at Washington, D. C., on June 23, 1927, where the U. S. Division of Plant Quarantine gave them a severe vacuum fumigation. Following this they were shipped to an isolated point in Nevada. On July 3, 1927, I received instructions to see that they were immediately planted in a thoroughly isolated location in southern Nevada. I was to select a place where they could be planted and cared for safely away from any other date palm. The extreme southern point of Nevada touches the Colorado river for a short distance about 22 miles north and up the river from Needles,

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Figure 1

A. View of the location in southern Nevada where the imported Medjool offshoots were first planted and the appearance of the offshoots in 1931, four years after planting.

B. One of the imported Medjool palms with crop of fruit borne in 1931 and the Chemehuevi Indians who helped care for the offshoots. Mike Tobin on the left. (Photos by Dewey Moore)

California. Having never been in that portion of Nevada, I was completely in the dark as to what I might find there.

I left the U. S. Date Garden alone in an old Ford coupe on July 3, 1927, with the expectation of spending the 4th of July alone on the hot, dry desert of southern Nevada. The temperature was then ranging around 116 in the Needles area. At Needles I was finally able to contact, by telephone, a railroad man who gave me the location of the Medjool offshoots, and I soon arranged for their immediate delivery in extreme southern Nevada near the Colorado river. I had expected to find it necessary to arrange with some Indian of the Needles locality to establish a camp in extreme southern Nevada and use his team, wagon and barrels to haul water from the Colorado river for irrigating these offshoots.

On the morning of July 4, 1927, I left Needles and followed a very dim wagon trail 22 miles up the river into this southern point of Nevada. I was impressed with the isolation of the locality. Soon after crossing the state line from California into Nevada I was most fortunate in finding the hut of an old and badly crippled Indian named Johnson. His wife was also very old and nearly blind. There happened to be two younger Indian men there for a short visit. All of them belonged to the Chemehuevi tribe of desert Indians.

One of the younger men, Mike Tobin, could converse fairly well in English. Through Mike, as interpreter, I made known the purpose of my visit. It soon developed that Mike had worked for my brother at old Fort Mohave and that they had enjoyed an extended and very friendly acquaintance. This helped me a lot in my introduction to these strange Indians.

Near Johnson's hut was an old dug well some twenty-five feet in depth — deep enough to tap the underground water from the nearby Colorado river. Over the well was an old broken-down wind-mill and pump (Fig. 1A). The well had caved in until it showed no water, but Mike assured me that a little digging would provide all the water required for the irrigation of the eleven offshoots.

Through Mike, as interpreter, I was soon given the approval of Johnson to put the well, pump and wind-mill in order and to use them for an indefinite time to water the dates. Johnson agreed to care for and turn on the wind-mill as needed to keep the offshoots well watered. He further permitted me to use about one-half acre of fairly level land situated slightly below the well where the water would flow by gravity to the offshoots. Nearby was an old fence with enough posts and wire to fence in the dates and thus protect them from the Indian ponies. Things were certainly coming my way. Here was a small patch of good, level soil, a

well, pump, wind-mill, posts and wire plus an old Indian residing there permanently who was willing, even anxious, to care for the dates. Also there were two young Indians willing to help me with a very strenuous 4th of July "celebration." Perhaps the patriotic 4th of July start given these dry offshoots may have improved their chance of survival, or perhaps the earnest prayers of that old Indian medicine man, Johnson, may have entered into it. Anyway it has always seemed to me a miracle that all of the eleven imported and thoroughly dried out offshoots not only survived, but actually grew vigorously right from the start.

I was asked later just why I employed such a badly crippled old Indian to care for these important offshoots. There were several good reasons. First because no one else was easily available. Second because Johnson's old age and badly crippled condition assured me that he could not leave the place on frequent and extended absences to attend all sorts of Indian gatherings which have irresistible attraction for practically all Indians. Perhaps this may represent one of the very rare cases where old age and rheumatism are an asset rather than a liability. Another point in favor of Johnson was that old Indians of his type can usually be depended upon faithfully to keep an agreement. Also both he and his wife were seriously in need of the

modest compensation I was able to arrange for them. They attended to this job faithfully for approximately seven years.

We finally finished the cleaning of the well and the repair of the pump and wind-mill and had them working satisfactorily. It took us until nearly midnight to complete the planting, irrigation and fencing.

As I unpacked the offshoots after a long, difficult day in the hot July sun, I was discouraged and depressed because the shoots all appeared completely dried out and without life. I noted that seven large shoots showed several small secondary shoots—more than normal for large offshoots of other varieties. I also noted that both the large and the small shoots, including those still attached to the seven large ones, showed plainly the beginning of root formation, and that fact gave me slight hope for their survival. The four small shoots were about the size of one's fist and forearm. Seven years later when the entire planting was moved to the U. S. Date Garden at Indio I again noted that tendency to very early formation of roots, even on very small shoots having no soil contact.

I made my first visit back to this isolated planting approximately sixty days later. I was astonished to find definite signs of life and even slight growth on each of the eleven imported offshoots. I encouraged Johnson in his excellent care of the plant-

ing, and it pleased him very much when I told him that he must be a real "Medicine Man," as indicated by his ability to make sick plants grow. He told me that he had asked the "Great Spirit" to help him, and I noticed that he increased his determination to do his best. A few months later, however, he became ill and could not get out even to turn the wind-mill on and off. His wife, who, as stated, was almost blind, cared for the irrigation during Johnson's illness. Because of her very poor eyesight she had not noticed that, during a few extremely hot days, their dogs had dug up two of the smaller shoots in trying to find a cool, moist bed. Some weeks later when Johnson was able to resume his work, he discovered what the dogs had done. He thought these two shoots had been exposed to the hot sun until they were completely dried out and were dead so he burned them on his camp fire. Thus the number of imported offshoots was reduced from eleven to nine.

These nine remaining shoots were kept in isolation for more than seven years. During that time they were inspected several times by State and Federal officials including Dr. H. S. Fawcett, Dr. Walter T. Swingle, Mr. A. J. Shamblyn and myself. No disease or insect pests were found on them at any time. The condition of the offshoots four years after planting is shown in figure 1.

Finally it was determined that it would be safe to transplant them in proximity to other date palms at the U. S. Date Garden. Mr. George H. Leach was assigned this important task. With the idea of increasing the chance of the originals to survive he first removed sixty-four offshoots, many of them quite small. Most of these sixty-four shoots were taken from the seven larger imported shoots. These sixty-four new offshoots plus the nine imported shoots (by this time young palms) made a total of seventy-three to be transplanted. The fact that every one of these survived not only was evidence of expert work by George Leach, but was additional evidence of the unusual hardness of this date variety. Added to this is the fact that all of the eleven imported shoots survived the long trip to the United States from Morocco and a severe vacuum fumigation on their arrival at Washington.

The young palms were moved to the U. S. Date Garden in the summer of 1935.

It would appear that the Medjool variety of date has several outstanding qualities in its favor. It is prolific in offshoot bearing. It is unusually hardy and is easy to transplant. It produces large, attractive berries and its offshoots begin the formation of roots when very young—even where the shoots have no soil contact.

EFFECTS OF WATER SHORTAGE DURING RIPENING AND OF NITROGEN FERTILIZATION ON YIELD AND QUALITY OF KHADRAWY DATES

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Experiments on the effects of moderate water shortage during the period of fruit ripening and of nitrogen fertilization on growth and yield of dates were carried out with the variety Khadrawy from 1947 through 1951 in the Coachella Valley at the U. S. Date Garden, Indio, California.

The experiment on withholding water during the ripening period had two main objects: (1) to learn whether subjecting the tree to water shortage would cause the fruit to dry out rapidly after ripening and thus reduce the spoilage that often occurs in humid or rainy weather; (2) and to determine whether withholding water for a long period just before and during ripening and harvest would affect the yield or grades of Khadrawy dates. It has been the

practice of some growers to withhold irrigation water, especially from heavy soils, during the harvest season for convenience in handling the harvest operations. There has been some concern as to whether this practice results in water shortage that might be harmful to tree or crop.

The fertilizer experiment was conducted on buffer rows between the irrigation plots. The object of this experiment was to determine whether liberal applications of nitrogen would affect growth of the trees and yield of fruit.

DESCRIPTION OF EXPERIMENTS

In the irrigation experiment the treatments were as follows: (1) wet, in which an ample supply of moisture was maintained all the time by applications of water about every two weeks in summer and at intervals of 3 to 6 weeks for the remainder of the year; and (2) dry, same

as the wet plots except that water was withheld for 2 to 3½ months just before and during fruit ripening. In each treatment there were five plots of two trees guarded on all sides by two buffer trees or rows.

The fertilization experiment was set up in guard rows between the irrigation plots, and each plot consisted of four trees on which records were kept. Two of these received the same irrigation treatment as the wet plots and two the same as the dry plots. The two treatments were: (1) fertilization (+N), inorganic nitrogen was applied at a rate of eight pounds a tree per annum; (2) no fertilization (-N), control. There were four plots of each treatment.

In both the irrigation and the fertilization experiment the annual increase in trunk height of all record trees was measured and the growth rate of leaves on two trees in each plot was determined by measure-

1. Senior horticulturist, formerly agricultural aid, and agricultural aid, respectively, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

ments of leaf elongation at intervals of one or two weeks, depending on the season and the rate of growth. In the period during which water was withheld from the dry plots, soil samples for moisture determinations were taken at approximately weekly intervals to a depth of six feet. Each season records of soil moisture and leaf growth were kept and charts were maintained to show the progressive drying of the soil in each of the dry plots, the seasonal course of normal leaf growth, and the effect of treatments on leaf growth in all plots of both experiments.

In the irrigation experiment the drought each year varied somewhat as to both duration of the period and the time at which the last application of water was made before the onset of drought. The date of the last irrigation preceding the drought period and the date of the first irrigation following it in the years indicated were as follows:

1947—July 15, Sept. 15
1948—July 16, Nov. 4
1949—July 25, Nov. 10
1950—July 27, Oct. 3
1951—July 28, Oct. 5

A heavy cover crop of sweet clover (Hubam) was grown during each winter and spring on all plots and disked into the soil each spring.

RESULTS

It is hoped that eventually a detailed report may be made of the responses of the palms in the irrigation experiment to the variations in soil moisture to which they were subjected, but only a brief summary of the results is given here.

The field water-holding capacity of the soil on which the experiment was conducted varies from about 12 to 30 percent in the top four feet and from about 4 to 30 percent in the fifth and sixth feet. This wide variation resulted in unequal rates of drying, so that, for example, in 1948 the soil moisture percentages of the soil in the top six feet of dry plot 1 had been reduced to about the wilting point by September 20, while in dry plot 5 only the top foot had reached the wilting point on this date.

Continuous graphs of the average daily rate of leaf elongation were maintained for the average of all wet plots and for each dry plot from June 1948 to October 1951. A comparison of these graphs with those representing soil moisture percentages in the dry plots during the drought periods shows that, in general, decreasing moisture content of the soil had little effect upon leaf growth in most of the plots in most seasons. Furthermore, as was found in a similar irrigation experiment

with Deglet Noor dates¹, the loss in rate of leaf growth during the period of water shortage was compensated for by an increase in growth rate on trees in the dry plots over that on trees in the wet plots during the spring and summer following the period of drought; thus total leaf growth for a season was about the same in both wet and dry treatments. The most severe stress for water occurred in 1948 when the drought period began in mid-July and ended about 3½ months later. In dry plot 1, which was on lighter textured soil than any of the other dry plots, about half of the available moisture in the top six feet of soil had been used by August 20 and the leaf-growth rate had fallen to about 2.7 centimeter a day (cm/d), while the average rate of the wet plots was about 3.5 cm/d. On September 20 the moisture content of the top six feet of soil in dry plot 1 had been reduced to about the wilting point and the leaf-growth rate had fallen to about 1 cm/d, while that of the wet plots was still 3.5 cm/d. In dry plot 3 in 1948 leaf growth was reduced to about two-thirds that in the wet plots from about September 15, when soil moisture was near the wilting point in the top five feet of soil, until November 4, when water was applied. In dry plots 5, 7, and 9 the waterholding capacity of the entire top six feet of soil was relatively high and the moisture content of only the top foot was reduced to the wilting point during the drought period. Leaf growth in these plots was somewhat higher than that in the wet plots before the onset of drought and during the last half of the drought period was, for the most part, only one or two tenths of a cm/d less than the wet average.

In the other years of the experiment the leaf growth rate in only dry plot 1 was reduced much below that of the average in the wet plots and in this plot the minimum rate of leaf growth was about 80 or 90 percent of that of the average of the wet plots. With the soil moisture content of the top 4 to 6 feet in the lower one-half to one-fourth of the available range of soil moisture, leaf

growth rate was affected much more in hot than in relatively cool weather; and when such soil moisture conditions occurred in September or later, only slight or moderate reductions in leaf growth rate resulted.

Even such moderate water deficits had some effect, however, upon ripening of the fruit and upon time of flowering in the following spring. The water deficits tended to hasten ripening of the fruit, but to delay emergence of the inflorescences. The end result was that, though the average pollination date was several days to a week later in the dry plots than in the wet plots, there was usually not much difference in the time of ripening of the fruit. Another effect of water shortage noticed during a few of the picks was that, in the dry plots, the vascular strands, which extend from the fruit pedicel to the seed, did not soften and pull loose from the seed readily in some fruit, but tended to pull the seed out of the fruit as it was picked or to hold the fruit so firmly to the fruit strand that it was damaged in picking. This trouble was not, however, common enough to affect appreciably the average grades of fruit obtained from the dry plots, except possibly in one or two picks.

The influence of nitrogen fertilization on growth rate of leaves was barely perceptible, but the average rate of growth of leaves on the fertilized trees was slightly higher than on the unfertilized trees almost continuously from the spring of 1949 to the winter of 1951.

The average annual gains in trunk height of palms in the irrigation and fertilization experiments are shown in table 1. The differences were very small and were nonsignificant. The average annual yields of fruit in the irrigation and fertilization experiments are shown in table 2. It is apparent that the differences in yield between the wet and dry treatments and the fertilized and unfertilized treatments were erratic, small, and statistically nonsignificant. Samples of fruit from each plot at each pick during the five years of treatment were graded to determine whether the treatments had any influence on fruit quality or on the amount of spoilage, which would be reflected in the amounts of culls produced. Since grading involved judgment in mak-

1. Furr, J. R., E. C. Currelin, R. H. Hilgeman and W. Reuther—An irrigation and fertilization experiment with Deglet Noor dates. Date Growers' Inst. Rept. 28: 17-20. 1951.

Table 1. Average annual increase in height of palm trunk (feet).

Treatment	1947	1948	1949	1950	1951	Mean 1947-51
Wet	0.9	0.8	0.9	0.9	0.9	0.9
Dry	0.8	0.7	0.9	0.9	0.9	0.8
F value						N.S.
+N	0.8	0.8	1.1	0.6	1.1	0.9
-N	0.7	0.7	1.1	0.7	1.0	0.8
F value						N.S.

Statistical symbol: N.S., difference between two means is not significant.

Table 2. Average annual yield of dates (pounds) per tree.

Treatment	1947	1948	1949	1950	1951	Mean 1947-51
Wet	215	185	162	212	193	193
Dry	209	174	146	210	222	192
F value						N.S.
+N	194	169	157	233	201	191
-N	192	188	173	222	191	193
F value						N.S.

Statistical symbol: N.S., see Table 1.

ing the separations, it was realized that our performance of this operation was erratic from pick to pick and from year to year. It was finally decided that, for statistical analysis, it would be advisable to combine the "Fancy," "Choice," and "Standard" grades into one (ABC). The Sub-standard (D) and Cull grades were treated separately. This provided three categories that we considered to be nearly free from overlapping boundaries. The average annual yields per tree of the three grades of dates during the five-year period of treatment are shown in table 3. The differences were not significant. Actually, in certain picks there were unquestionably real differences in the yields of certain grades between wet and dry treatments, but when the averages of any one year or of the five years as a whole were considered, it was found that these differences were obscured by the many variations, and statistical analysis of each year separately or of all years of treatment combined showed the difference to be nonsignificant.

Table 3. Average annual yield in pounds per tree of standard or better (ABC), sub-standard (D), and cull grades of dates during the five years (1947-51) of treatment.

Treatment	ABC	D	Culls
Wet	126	39	28
Dry	112	52	28
F value	N.S.	N.S.	N.S.

Statistical symbol: N.S., see Table 1.

DISCUSSION AND CONCLUSIONS

During the five years of these experiments there were no harvest seasons of protracted rainy or extremely humid weather, and consequently, conditions were not especially favorable for testing the effect of the soil-drying treatment on fruit spoilage. The weight of culls, which would reflect spoilage, was small and about the same in both treatments. If prior to each irrigation the palms in the dry plots of the irrigation experiment had been subjected to periods of water shortage such as those applied in only late summer and fall, it is possible that they would have been more seriously affected than they were. It seems, however, that subjecting the palms to water shortage after the

fruit had reached full size and sugar content had very little effect on yield or grades of fruit, even if the rate of leaf growth was affected appreciably. From the results of this experiment it seems likely that irrigation water could be withheld from soils of similar texture during the harvest season without fear of harmful effects, since such drying of the soil need not be started until just before harvest begins and need not be continued for more than two months. On light, sandy soils of relatively low water-holding capacity the period of drying could not be so long as on sandy loams or heavier soils without causing severe water shortage.

Had there been several seasons of rainy or excessively humid weather during the course of the irrigation experiment, it is possible that there would have been appreciably greater spoilage of fruit in the wet plots than in the dry plots. The results of this experiment, however, suggest that there would usually be too little reduction in fruit spoilage to justify subjecting the palms to water shortage each harvest season, unless withholding water is practiced for some other reason, such as convenience in carrying out harvesting operations.

The results of the nitrogen fertilization experiment show that supplying the trees in the fertilized plots with liberal applications of readily available nitrogen over a period of five years had very little effect on growth and apparently none on yield. It seems likely that nearly, if not entirely, adequate amounts of nitrogen were supplied to the trees in the unfertilized plots through breakdown of the native supply of organic matter in the soil and probably to an appreciable extent from nitrogen fixed by the cover crop of sweet clover that was grown each season. These results suggest that on soils of medium and heavy texture there may be considerable waste of nitrogen in gardens that receive liberal applications of nitrogen fertilizers each year.

SUMMARY

Experiments on the effects of water shortage during the fruit-ripening period and of nitrogen fertilization were conducted with the variety Khadrawy from 1947 through 1951. The irrigation treatments were: (1) wet, in which an ample moisture supply

was maintained, and (2) dry, in which irrigation water was withheld during a period of 2 to 3½ months just prior to and during the fruit-ripening period. The fertilization treatments were: (1) +N, fertilization with inorganic nitrogen at a rate of eight pounds a tree per annum and (2) -N, no fertilization.

The soil on which the experiments were conducted varied greatly in the water-holding capacity of the top six feet, so that the severity of water shortage also varied greatly. In one plot in one season the soil in the top six feet was reduced to the wilting point and the leaf growth rate was reduced to less than a third of that in the wet plots. In general, though the moisture content of the soil was reduced to one-fourth or less of the available moisture in the top 5 or 6 feet, leaf growth rate was reduced only slightly during the period of drought, and total growth for the year was as great in the dry treatment as in the wet treatment.

Between treatments in both the irrigation and the fertilization experiment the differences in annual trunk growth and in yields of fruit were small and statistically nonsignificant.

In certain picks the dry treatment had some effect on the quality of the fruit harvested, but this effect was not consistent and the differences in grade of fruit from the two irrigation treatments were not significant in any one year or in the five-year period as a whole.

The results of the irrigation experiment indicate that on soil of medium texture the practice of withholding water during harvest will have little influence on yield or grade of fruit and may be practiced for convenience in performing harvesting operations with little fear of harmful effects. The results of the nitrogen fertilization experiment suggest that some of the Coachella Valley soils of medium to heavy texture are well supplied with nitrogen and that long-continued, heavy annual applications of nitrogen on such soils are wasteful.



NITROGEN CONTENT OF PINNAE, FRUIT, AND SEED OF DEGLET NOOR AND KHADRAWY DATE PALMS AS RELATED TO NITROGEN FERTILIZATION

By J. R. Furr and James A. Cook¹
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This paper reports the results of nitrogen analyses of pinnae, immature fruit tissue, and seeds from trees in control and fertilized plots of nitrogen fertilization experiments conducted with the date varieties Deglet Noor and Khadrawy. The influence of nitrogen fertilization on growth and yield of the palms in these experiments has been described elsewhere (2, 3).

In many herbaceous plants and fruit trees and also in the oil palm (1), it has been found that the mineral composition of some selected tissue, as the leaf, is related to the mineral nutrition of the plant. In such plants it has been found that deficiency of certain nutrients or a lack of proper balance between them was indicated by the amounts of these nutrients or by the ratios between them found in the tissues of the test plants as compared with the amounts or ratios found in the tissues of normal plants adequately supplied with the essential nutrients.

There is little published information regarding the relation of mineral composition to nutrition in the date palm. Reuther (4) investigated the mineral composition of date leaves in relation to vigor of palm, age of leaf, and location of the palm in the Coachella Valley, California. He concluded that the results suggested no widespread, severe deficiency of any of the nutrient elements studied, among which was nitrogen. Sinclair, Bartholomew and Bliss (5) determined the nitrogen content of fruit samples (pulp) from unfertilized control plots and from those heavily fertilized with nitrogen. They found small differences in nitrogen content, but drew no conclusions regarding the relation of nitrogen content to fertilization treatment.

In the experiments referred to previously (2, 3), statistically significant differences in yield were obtained from the fertilized and unfertilized plots of Deglet Noor palms, while practically no differences in yield were obtained from the fertilized and unfertilized plots of Khadrawy palms. We were thus led to hope that analyses of tissues from the palms in these two experiments might reveal a relation between nitrogen content of leaf tissue and nitrogen nutrition of the palm.

MATERIALS AND METHODS

Briefly, the nitrogen fertilization experiment with Deglet Noor palms consisted of ten two-tree plots in each of two treatments: (1) no fertilization, control (—N), and (2) fertilization with nitrogen from an inorganic source at the rate of six pounds a tree per annum from 1944 through 1946 and eight pounds a tree per annum from 1946 through 1950 (+N). The nitrogen fertilization experiment with Khadrawy palms consisted of four four-tree plots in each of two treatments: (1) no fertilization, control (—N), and (2) fertilization with nitrogen from an inorganic source at the rate of eight pounds a tree per annum from 1947 through 1951 (+N). On all the Khadrawy plots a heavy cover crop of sweet clover (Hubam) was disked in each spring.

Separate samples of pinnae and of fruit were taken from each tree in each plot and analyzed separately. Each leaf sample consisted of 12 pinnae, four taken from the mid-portion of the blade of each of the three youngest mature leaves on the palm. These leaves are described as "top head" by Reuther (4). Each fruit sample consisted of 10 fruits of average size for the tree sampled. The seed samples were made up of the ten seeds from the fruit sample. Samples were dried in a forced-draft oven at 80° C. until dry enough to grind in a Wiley mill. After grinding they were re-dried in a vacuum oven and analyzed for nitrogen by the standard Kjeldahl method.

EXPERIMENTAL RESULTS

The average percentages of nitrogen in the pinna, fruit, and seed samples from the fertilization and no fertilization treatments in the Deglet Noor experiment are shown in table 1. It is apparent that in this experiment nitrogen fertilization re-

sulted in highly significant differences in the nitrogen content of not only leaf tissue but also immature fruit-pulp and seed.

The correlation coefficients between percentages of nitrogen in pinnae and yields in the Deglet Noor experiment are shown in table 2, and the average yields referred to in table 2 are shown in table 3. Since, if a correlation were perfect, the coefficient would be one (1.0), it is clear that in most cases the correlation between nitrogen content of the leaf and yields was not very high. But since all of the values are significant except two, and one is highly significant, there was a definite relation between nitrogen content of the leaf tissue and yields. The average yields per tree are also shown (table 3) because these data in connection with the correlation coefficients suggest that in the years of heavy yield there was, in general, closer correlation than in the years of light yield.

The average nitrogen percentages of pinnae, fruit, and seed from the fertilized and unfertilized plots in the Khadrawy experiment are shown in table 4. It will be recalled that in this experiment nitrogen fertilization had no apparent effect on yield, and, as might be expected, the differences in the nitrogen content of fruit and seed from the two treatments were insignificant; there was, however, a small but significant effect of nitrogen fertilization on the percentage of nitrogen in the pinnae.

DISCUSSION AND CONCLUSIONS

It is not entirely clear why nitrogen fertilization had a significant effect on the nitrogen content of the leaves in the experiments with both the varieties Deglet Noor and Khadrawy, but affected yields in only the experiment with the variety Deglet Noor. It is reasonable, however, to expect that nitrogen fertilization

Table 1. Average nitrogen content (percent dry weight) of pinnae, fruit, and seed of Deglet Noor palms.

Treatment	Pinnae		Fruit		Seed
	Aug. 1947	June 1950	Aug. 1950	July 1950	July 1950
+N	1.53	1.85	1.81	0.89	0.97
—N	1.37	1.68	1.65	0.82	0.90
Diff.	0.16**	0.17**	0.16**	0.07**	0.07**
L.S.D. at .01	0.14	0.07	0.08	0.03	0.03

Statistical symbols:

**Difference between the two means is significant by odds of more than 99:1.

L.S.D.—Least difference for significance between the two means at the probability level indicated.

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Table 2. Correlation between nitrogen content of pinnae and yield of Deglet Noor palms.

December 1947	pinnae and 1947 yield=0.33*
December 1947	pinnae and 1948 yield=0.51**
June 1950	pinnae and 1950 yield=0.15 N.S.
August 1950	pinnae and 1950 yield=0.34*
June 1950	pinnae and 1951 yield=0.19 N.S.
August 1950	pinnae and 1951 yield=0.33*

Statistical symbols:

*The odds are more than 19:1 that the correlation is significant.

**The odds are more than 99:1 that the correlation is significant.

N.S. Correlation is not significant.

Table 3. Average yield (pounds per tree) of fertilized and unfertilized Deglet Noor palms.

Treatment	1947	1948	1950	1951
+N	179	260	231	284
-N	158	202	193	244

would affect the nitrogen content of leaves to a greater extent than yield, because yields were undoubtedly affected by such factors as pruning, thinning, frost injury, water supply, and differences in number and size of inflorescences produced by the two varieties, as well as by nitrogen supply. It is likely that one reason why there was less difference in nitrogen content of the tissue samples from the fertilized and unfertilized plots in the Khadrawy experiment than in the Deglet Noor experiment is that a heavy crop of sweet clover was turned under annually on all plots and that this added appreciable amounts of nitrogen to the unfertilized plots. It is also probable that because of a lower sand content the natural fertility of the soil in the Khadrawy experiment was higher than that in the Deglet Noor experiment. Thus, it seems likely that there was less difference in nitrogen supply to the trees in the fertilized and unfertilized plots in the Khadrawy experiment than in the Deglet Noor experiment.

It is possible that yields may be more closely related to nitrogen content of the leaves if the trees are allowed to bear to full capacity than if heavy thinning is done and the crop is reduced to less than the trees could produce. Because of the short fruit stalks and the difficulty of handling heavy bunches of soft fruit, the Khadrawy palms were thinned

more heavily than the Deglet Noor. The trees in the Deglet Noor experiment were allowed to carry as many bunches as they would produce. This apparently resulted in alternate bearing and possibly in a greater difference in efficiency of food manufacture in the fertilized and unfertilized trees in the years of heavy yield than in the years of low yield.

These results, so far as the writers are aware, are the first to be reported that show a relation between the nitrogen content of foliage and a nitrogen deficiency in the date palm; and while they are far short of constituting an adequate basis for the application of leaf analysis to determining the nitrogen needs of this crop, they show that the method has considerable promise of being applicable to the date palm. If this should prove to be the case, it would be particularly fortunate because of the extraordinary difficulty and expense of conducting field fertilizer trials with the date.

SUMMARY

Pinnae, fruit-pulp, and seed from trees in nitrogen fertilization experiments conducted with Deglet Noor and Khadrawy date palms were analyzed for nitrogen to determine whether the amounts of nitrogen found in these tissues were related to nitrogen fertilization and to yields.

In tissues from the Deglet Noor experiment, in which it has been reported elsewhere that yield of the

fertilized trees was significantly higher than that of the unfertilized trees, nitrogen percentages also were higher in samples from the fertilized trees than in those from the unfertilized ones, and the differences were highly significant. Positive correlations between percentages of nitrogen in pinnae and yields were also significant in four out of six cases.

In the Khadrawy experiment, in which it has been reported elsewhere that yields were not affected by the nitrogen applications, it was found that nitrogen fertilization caused a small, but significant increase in the nitrogen content of pinnae, but differences in the nitrogen content of fruit and seed were insignificant.

The results of the investigation indicate that leaf analysis will probably prove useful in future studies of the nitrogen needs of the date palm.

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Table 4. Average nitrogen content (percent of dry weight) of pinnae, fruit, and seed of Khadrawy palms.

Treatment	Pinnae		Fruit July 1950	Seed July 1950
	June 1950	Aug. 1950		
+N	1.54	1.52	0.80	0.85
-N	1.49	1.44	0.81	0.84
Diff.	0.05*	0.08*	0.01 N.S.	0.01 N.S.
L.S.D. at .05	0.04	0.05		

Statistical symbols:

*Difference between the two means is significant by odds of more than 19:1.

N.S. Difference between the two means is not significant.

L.S.D.—Least difference for significance between the two means at the probability level indicated.



SAFETY IN THE DATE INDUSTRY

By William A. Wilson¹

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When H. W. Heinrich of the Travelers Insurance Company analyzed the reports of 50,000 work injury cases, he concluded that two percent were unpreventable; 88 percent were due to improper supervision; and 10 percent resulted from physical conditions.

Under supervisory causes he listed: faulty instructions; poor discipline; lack of concentration; mental or physical unfitness.

Under physical causes were: poor housekeeping, improper planning; physical hazards; defective equipment; unsafe building conditions; improper working conditions; improper wearing apparel.

These causes are apparent as one examines the equipment furnished on date ranches. Most of the ladders are in good condition, while others need to be repaired or condemned. The safety orders of the Division of Industrial Safety prohibit the painting of wooden ladders, on the theory that paint may cover a defect. The orders recommend oiling, shellacking or varnishing. Some of you have noticed that the wooden ladders used by the telephone company are not painted, but varnished. It is common practice among large citrus packing houses to coat ladders with linseed oil.

As for picking saddles, a similar variety of working conditions was found. Many were in first class condition, and a lesser number needed repairs or replacement. The recent death of an experienced picker can be traced directly to a saddle that should have been discarded long before. Here the supporting rubber belting had gradually worn through until it no longer could support the weight of the picker. And who among us would say that such a fatal injury was not preventable?

The manner of suspending these saddles has an important bearing on the safety of the picker. Reports of three fatal injuries state that the pickers were using saddles suspended on chains provided with two hooks having automatic snaps. In one of these cases it is thought that the picker was in the act of removing the chain from the date frond; that the chain caught in the frond and, when a strong pull was given, rebounded, struck the picker on the forehead, and stunned him so as to cause him to lose his grip and fall. We are unable to learn all the facts involved in these fatal injuries; only by adding the known facts to theories,

do we reach conclusions. One theory is that only one hook was used and it became dislodged when the picker was moving from one position to another; thus the accident would not have occurred had both hooks been used. Another theory is that the picker failed to attach either hook. Whatever may have been the cause, we reach one conclusion—that had proper supervision been exercised and proper physical conditions existed, in all probability the fatalities would not have resulted.

The claim has frequently been made that pickers refuse to use both hooks. A ranch foreman who claims to have had not one serious accident on his ranch during the past twenty-five years remarked that a worker who refuses to follow instructions does not continue to work on his ranch. Industrial plants long ago found it necessary to lay down restrictive orders, with the result that the frequency of work injuries dropped. Thus, we may conclude that where such saddles are used, use of both hooks should be required.

One picking-contractor who employed many pickers during the past season without a disabling injury to a worker admitted that twelve of his pickers fell during the season though fortunately none was injured. He stated that all the pickers who fell were using the chain and double hook type of suspension. He was of the opinion that each fall was due to failure to attach the second hook; that the one hook became disengaged as the picker was maneuvering from one position to another. This contractor also uses many saddles provided with a large steel hook that hooks over the frond. A chain connects the hook to the saddle. He reported that no falls were experienced by pickers using the steel hook; that the pickers were able to change from one position to another more quickly and easily than those using the other type of saddles. "And this," he added, "means more dates at the end of the day, which in turn raises the income of the picker, all with less fatigue."

The inference drawn from this contractor's experience is that a saddle with the steel hook type of suspension is safer than those with two snap hooks.

On a large ranch with a long record of safe operation Mexican nationals are employed and considered splendid workers. Upon being asked how he attained this enviable record, the foreman stated that the workers were trained before starting to work.

He illustrated this by showing how he instructed them to carry a ladder and place the upper end well up into the fronds of the tree so it would not turn and slip. All of this equipment, he said, was regularly inspected and repaired if necessary; ladders were braced and tightened. He insisted on workers following instructions.

When asked about thorn punctures, he stated that the workers were instructed to make clean cuts and get all the thorns off the fronds; that two workers had just finished de-thorning more than fifty acres of mature date trees with only one minor thorn puncture. The thorn was removed by the foreman, the wound was treated with an antiseptic, and the worker continued working. It was this foreman's opinion that accidents on date ranches would stop when the owner decided to stop them. It was apparent that on this ranch both supervision and care of physical factors are a part of the successful safety record. Safety pays dividends to both workers and management on this ranch.

It seems a part of our nature to think that we will never suffer a disabling injury; that it will always be the other fellow. Yet in California more than 14,000 farm employees are reported injured annually in accidents — many fatally. Only employees covered by compensation insurance are included in these reports. The farmer and members of his family, employees of self-insuring farmers and those rejecting the compensation features of the labor code do not report their work injuries to our statistical division.

In the Coachella Valley, within a period of four months, 166 disabling injuries were reported, including three fatalities. The insurance company covering these losses claims that more than \$22,000 has been paid for medical and hospital expenses and compensation in these cases; that this represents a loss ratio of 73.5 percent; that for every dollar received as premium seventy-three and a half cents were paid out for these losses. Of the 27 compensable cases the average cost per case was \$756.00. There were 94 non-compensable cases averaging \$15.30 medical expenses per case, and several open cases at the time of this report that averaged \$12.50 per case.

In the 1951 Division of Labor Statistics and Research report on work injuries occurring in the Coachella Valley date industry, 98 cases were listed. Of these cases of injury

1. Agricultural Safety Engineer.

48 were received in picking dates, 26 in pruning and dethorning, 12 in bagging bunches and pollinating, 4 in moving ladders, 2 in setting and moving trees, and 6 in other operations. In 75 cases the instruments involved in the injuries were: thorns, 36; picking saddles, 19; ladders, 13; hand tools, 7.

We have come to regard carelessness as something we can do nothing about; that it is just tough luck, and so we do nothing about the prevention of accidents. Years ago the cement industry over the country topped the list with its high frequency of work injuries. Today these same cement plants operate two,

three and five years without a disabling injury to an employee. This splendid record was accomplished because the cement industries made safety a number one factor in their operations. Carelessness was not tolerated. Each foreman was responsible for safe operation in his department. The Riverside Cement Company is no exception to this order. If you were to visit that plant, you would see near the office a large cement monument erected in commemoration of years of safe operation. There are hundreds of extremely hazardous operations in the cement industry, yet the workers are not injured because safety comes first.

I know a rancher, or rather a former rancher, who lost his ranch when a judgment was rendered against him involving an injury to an employee. I knew a dairyman who died as the result of tetanus, leaving a wife, two children, and a dependent mother. An accident may be the difference between success and failure; it may be the difference between happiness and sorrow.

Can you prevent accidents on your date ranch? Your neighboring rancher does. Thousands of ranchers in California go, year after year, without a disabling injury to an employee. Such operators are valuable assets to their community, state and nation.

ASSOCIATION OF SULFUR CONTENT WITH ACIDITY AND QUALITY IN DATES

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A relatively high acid content in dates has been shown to be associated with a condition referred to in the trade as "dry" and, in extreme instances, as "rubbery" (1). The dry condition does not necessarily mean that the moisture content is too low for good quality, but rather that the texture is that of an incompletely matured and cured fruit. The appearance of the affected dates is rather unattractive, but the flavor may be excellent and the sugar content is as high as that in dates of better grades. The usual trade practice is to treat dry dates such as these with steam or very humid warm air under carefully controlled conditions of time and temperature before they are placed on the market. Dates with a rubbery or spongy texture fail to respond to moderate steam treatment and are normally ground and marketed as a by-product.

The amount of acid in dates is low and the flavor is not adversely affected by it even in low-grade fruit relatively high in acid. High-quality dates usually have a pH value above 6, whereas rubbery dates usually have a pH value below 5. The various dry grades usually fall within the range of pH 5 to 6. Factors other than acidity are associated with dryness in dates since occasional samples of dry dates which do not have a high acid content are found. Some still undetermined climatic factors are probable contributory factors because the amount of dryness varies considerably from season to season.

To learn whether there might be a relation between the acidity of dates and their sulfur content, the active acidity and the total sulfur content of a number of individual

fruits and samples composited from several fruits were measured.

Individual ripe Deglet Noor fruits of the 1949 and 1950 crops were selected to represent all available degrees of quality. The sulfur contents and pH values of these fruits are shown in figure 1, the curve of which was fitted by eye. These data show a definite association between sulfur content and pH, high sulfur being associated with a high active acidity (low pH value), which has already been shown to be associated with low quality. As the sulfur was measured as total sulfur, the data give no information on the nature of the sulfur-containing compounds.

Most date growers dust their date palms with a fine sulfur dust in the early part of the growing season for the control of mites. This dust might be suspected of being the source of the high sulfur content and the high acidity of the dry dates, for sulfur applied to the surface of plant tissues has been shown to be absorbed and converted into acid (2, 3). The irregular occurrence of the dry fruits

and of dry tissue on some individual fruits could be attributed to the irregular adherence of the sulfur dust to the surface of the fruits.

With this possibility in mind 2 bunches on each of 10 Deglet Noor palms on the United States Department of Agriculture Date Garden at Indio, California, were dusted with sulfur, while 2 others on the same palms were covered to prevent sulfur from drifting onto them. On the nonsulfured bunches mite control was obtained by the application of miticides that did not contain sulfur. The dusting was done early in June, 1951.

Eight successive collections of dates were made from the sulfured and the nonsulfured bunches during the growing season. The pH values and the sulfur contents of these samples are given in table 1. It is obvious from these results that the sulfur dust did not increase the acidity or the sulfur content of the dates.

Two similarly treated plots in the garden of T. R. Brown of Thermal,

Table 1. The pH values and the total sulfur contents of nonsulfured and sulfured Deglet Noor dates.

(Sulfur expressed as percentage of dry weight)

Date	pH		Sulfur content	
	Nonsulfured	Sulfured	Nonsulfured Percent	Sulfured Percent
June 6, 1951	5.54	5.54	0.0910	0.0903
July 17	5.56	5.56	.1305	.1363
July 31	5.83	5.71	.1315	.1360
August 14	5.75	5.79	.1041	.1023
September 4	5.48	5.63	.0855	.0769
September 20	5.72	5.75	.0711	.0680
October 2	5.56	5.71	.0656	.0632
October 25	5.77	5.94	.0570	.0646
October 25	5.92	6.06	.0615	.0611
October 25	6.10	6.11	.0560	.0563
Average	—	—	.0854	.0855

California, were also used. In these plots samples were taken toward the end of the growing season only. The last two collections for October 25 listed in table 1 were obtained from these plots. The data from these collections were in agreement with the others given in table 1.

Sulfur content of immature dates did not appear to be related to active acidity until about September 1. Dates picked after that time showed a pronounced association between high sulfur content and high acidity.

These data are not sufficient to permit drawing final conclusions, but they do not give any support to the theory that the dusting sulfur used in the control of date mites contributes to the high acidity and the high sulfur content associated with dry grades of dates.

SUMMARY

High sulfur content in ripe Deglet Noor dates was found to be associated with high active acidity. This relation did not exist in immature dates during that part of the growing season prior to about September 1 but after that time it was very pronounced.

The dusting sulfur used for the control of mites did not increase the active acidity or the sulfur content of the dates.

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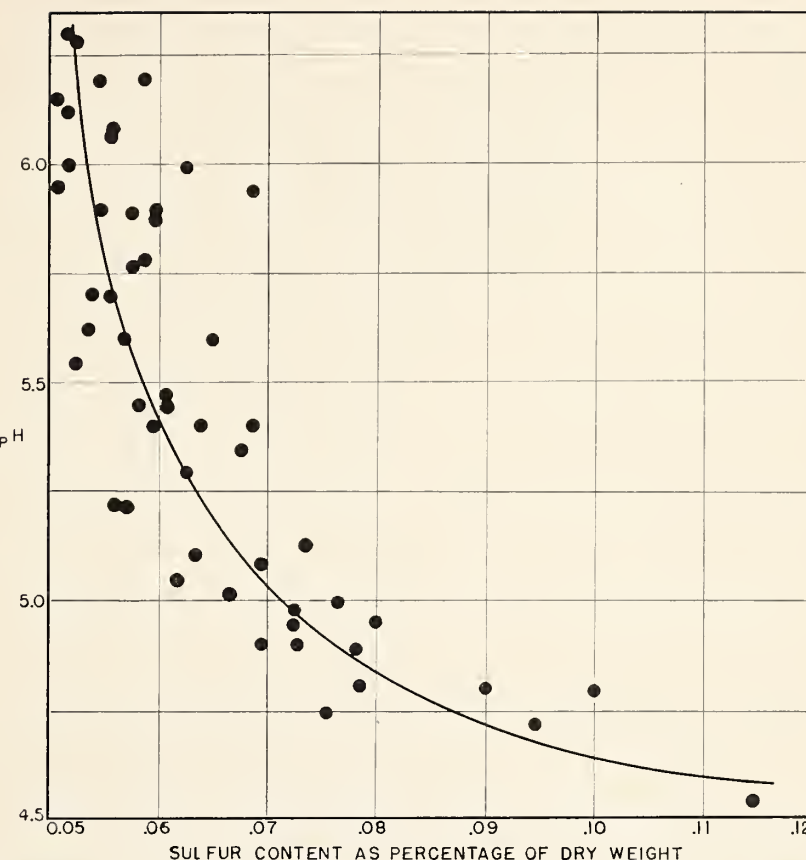


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DATE CONSUMPTION AND CONSUMER BUYING

By Varden Fuller

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That Americans have not become heavy consumers of dates is a fact long known to date growers and handlers. Annual per-capita consumption has been only one-fourth to one-half pound. Moreover, there has been no significant upward trend in per-capita consumption for the last three decades. When the abnormal war years are excluded, the per-capita consumption for each of the three past decades is approximately the same, namely, an average of about four-tenths of a pound per year in each decade. Both domestic and imported dates are included in these figures.

Recently, through the operation of the Date Advisory Board and from

several surveys, valuable new information on the economics of the date industry has become available.¹ From this information, some lessons may be learned, particularly with respect to retailer practices and consumer buying habits. Knowing more about these matters, the industry should be in position to market its output more effectively. The following observations, based largely on this recently available information, may suggest some possibilities.

WHO ARE THE DATE BUYERS? — Consumers who buy dates are greatly outnumbered by those who do not. The small percentage who are buyers make approximately two purchases each six months; these active buyers

apparently use dates in fairly large quantities. The best date customers are small families in the upper income brackets where the head of the family is a comparatively well-educated, professional man or executive, and where the housewife is over forty-five. Such families are not only more likely to be purchasers of dates but also to buy them more consistently throughout the year. Conversely, larger and younger families and those at the low end of the economic and educational scale are less likely to be date consumers and, moreover, are inclined to limit their purchases more exclusively to the Christmas holiday period.

Another recent finding that should

1. Reference is made to the following: (1) the statistics on consumer purchases and availability in retail stores obtained by Industrial Surveys Company, Inc., under contract to the U. S. Department of Agriculture and the Date Advisory Board. These data are issued monthly, quarterly, and in special reports by the Bureau of Agricultural Economics and the Production and Marketing Administration, U. S. Department of Agriculture. (2) The operational and annual reports of the Date Advisory Board. (3) Date Marketing Survey conducted by Julian Randolph, Bureau of Markets, California State Department of Agriculture, 1951.

be of interest is that many consumers who buy dates do not know whether the dates they have bought are domestic or imported. For the nation at large, the buyers of almost one-fourth of the total dates sold annually (domestic plus imported) could not identify their date purchases. The proportion of unidentified dates is largest in the Northeast and is smallest in the Pacific region. But, even in the latter instance, approximately one buyer in eleven does not know which type of date he has bought. The date buyers at the Christmas holiday peak are far less aware of the identity of the dates they have bought than are the buyers of other seasons.

Approximately one-third of the total dates purchased at retail are bought in December. The months of December and November together account for more than one-half of the year's total. During the summer—May through September—when sales are at their lowest point, less than 5 per cent of the year's total is sold in any one month and the total for this five-month period is between 5 and 10 per cent of the volume for the year.

At the sharp seasonal peak of sales in November-December, the number of date buyers increases materially but the average size of purchase increases only very slightly. Hence, this seasonal sales peak would appear to be produced by the entry into the market of customers who do not buy dates at any other time of the year.

These various facts suggest the hypothesis that the consumers of dates fall into two general classifications: (1) a small group—perhaps one family in twenty—which uses dates with considerable regularity all through the year; (2) a larger group—perhaps one family in five—which uses dates principally or exclusively at the Christmas holiday period. It would appear that the remaining three-fourths of the population uses dates only very incidentally and irregularly or not at all.

WHERE ARE DATES SOLD?—Outside of the South, where date consumption is exceptionally light, and the Pacific Coast, where consumption is exceptionally heavy, per-capita consumption rates are rather similar throughout the various regions of the United States. However, the question of regional distribution can be dealt with more significantly if sales of domestic dates and of imported dates are separated. Some contrasts then are seen which would appear to have considerable importance.

In the South, date consumption per capita is only about one-fourth the national average and imported

dates outrank domestic dates in the ratio of approximately eight to one. At the other extreme, date consumption per capita on the Pacific Coast is more than two and one-half times the national average and in this region domestic dates outsell imported dates by approximately ten to one. This high ratio of domestic dates and heavy total consumption on the Pacific Coast are both reflections of the fact that more than two-fifths of the California date crop is marketed in this region. Although the sales of imported dates tend to be concentrated in the Northeast and North-Central regions near the ports of entry, it is nevertheless true as a general proposition that the imported date is more evenly distributed over the whole country than is the California date. A very sharp contrast in point is that, whereas 14 per cent of the imported dates sold in 1950-51 went into the South, only 1 per cent of the California dates sold in the same year went into the South.

AVAILABILITY OF DATES IN RETAIL FOOD STORES.—This spotty regional picture is, in turn, reflected in the numbers and proportions of retail food stores which handle California and imported dates. In information on this subject is at present limited to surveys covering February and May of 1951. In these two months, the percentages of the nation's retail food stores in which California and imported dates were available were as follows:

	Feb., 1951	May, 1951
California dates	11.3	6.2
Imported dates	40.2	29.4

The indications of significance to be seen in these data are that California dates are available in only a small fraction of the nation's retail food stores; imported dates are far more available than are California dates; and California dates are available in almost twice as many stores in February as in May.

The above are nation-wide figures and, as may be expected, there are wide variations in availability by locality and type of store. However, the availability percentages for California dates are uniformly lower than for imported dates, regardless of locality, type or size of store, or class of customers. Some of the situations in which the availability of

California dates most nearly approaches that of imported dates, and the corresponding percentages of availability are shown in Table 1.

Note that, at the best, availability approaches two to one in favor of the imported date and that, even in the city of Los Angeles, the percentage of retail food stores handling imported dates exceeds the percentage handling California dates.

The lowest availability percentages for California dates are found in the smaller stores, in the independent groceries, in cities and towns of less than 100,000 population, and in the South and Mountain-Southwest regions. In these instances imported dates are available in five to six times as many stores as are California dates.

The data on retail store availability demonstrate that slackened consumer buying after the winter peak is accompanied by decreased proportions of retailers handling dates. Again, this is particularly true for the domestic date. These correlated patterns of behavior suggest this significant question: do retailers discontinue the handling of dates in the spring and summer because they think consumers will not buy them or do consumers quit buying dates because they are no longer to be had in the retail store they usually patronize?

THE REGIONAL MARKETING PATTERN FOR DATES.—Perhaps a comparison of the regional distribution of California dates with the regional distribution of other specialty crops which are exclusively or largely California grown will be instructive. For the purpose of this comparison, dried prunes, dried apricots, dried figs, and raisins have been chosen. This does not imply that the commodities named are considered to be substitutes for or competitors of dates; rather, the only purpose of the comparison is to answer the question of whether the regional sales outlets for California dates are different or about the same as for the other California-grown specialties. Of the total of each of the crops listed, the percentages sold within the respective regions are shown in Table 2.

The outstanding fact immediately apparent in the foregoing comparison is that California date producers rely to a far greater extent on the Pacific Coast market than do the

Table 1. Some of the situations in which the availability of California dates most nearly approaches that of imported dates, and the corresponding percentages of availability.

Stores	California dates		Imported dates	
	February	May	February	May
Stores with \$500,000 sales volume	55	32	88	78
National chains	52	28	88	77
Stores in cities of 500,000 or more	15	11	39	26
Pacific region	43	25	50	47
New York City stores	22	11	32	21
Los Angeles stores	40	27	47	28

Table 2. Regional sales outlets for California dates, as compared to other California-grown specialties.
(Figures are percentages)

Commodity	Northeast	North-Central	South	Mountain-Southwest	Pacific	United States
Domestic dates	19	26	1	11	43	100
Imported dates	28	39	14	13	6	100
Dried prunes	33	29	17	10	11	100
Dried apricots	33	30	11	19	7	100
Dried figs	40	18	8	11	23	100
Raisins	25	31	18	11	15	100

producers of any of the other California-grown specialties. Conversely, the other crops are distributed more proportionately into the Northeast and in overwhelmingly greater proportions into the South. In general, the pattern of regional distribution for imported dates and the patterns for other California-grown specialties are similar while the regional pattern of California date distribution differs from all of them.

Again, availability in retail stores enters the picture. Nationwide, these other California-grown specialties are available in from two to twelve times as many retail food stores as are California dates. Much higher levels of availability are maintained by the other specialties in the small stores, in the small towns and cities, in the Northeast and in the South. Very significantly, the independent grocery is utilized as a sales outlet to a much greater extent for other California-grown products than for dates.

WHAT DO THESE FACTS MEAN?—

The implications of these findings for those concerned with the marketing of California dates would appear to be fairly obvious. Although the findings do not necessarily indicate the desired or required changes in marketing practices, and they certainly do not prescribe the manner in which desired changes should be brought about, they do, nevertheless, raise some questions that the California date industry should consider. Briefly summarized, the most important questions would appear to be these:

1. Should the California date industry not endeavor to achieve a broader and more uniform regional distribution of its products? This would mean less dependence on Pacific Coast and California markets and more emphasis on sales in the Northeast, possibly in the Mountain-Southwest region and certainly in the South.

2. Should the California industry not take measures toward achieving a higher and more uniform level of

availability of its product in retail food stores? This would mean, particularly, more attention to independent groceries, to smaller stores, and to stores in small cities and towns. At present, there would appear to be a disproportionate reliance on national chains and a neglect particularly of independent groceries, which situation, in turn, probably reflects excessive reliance on produce jobbers at the neglect of wholesale grocers.

3. Should the California industry not consider whether there are means available to increase the consumption of dates outside of the winter holiday period? This problem has confronted the industry for a long time, but the view of it may be improved by clearly understanding that selling of dates in the spring and summer is at least as much of a problem of persuading the retailer to handle the product as it is to persuade the consumer to buy it.

4. Is there much to be gained by attempts to persuade consumers to be better date buyers until the product is more generally available to them? Although the three-fourths of the population which evidently never buys dates or only buys them very incidentally is doubtless a great potential market, there would appear little value in trying to persuade these people of the value of California dates when so few of them would be able to find the product in retail food stores.



A METHOD OF POLLINATING DATES

D. B. W. Alexander

Mecca Date Grower

The "blow" pollinator is essentially a labor saver and time saver. The basic idea back of it is to blow the pollen into the newly opened bunches from the ground rather than tying in either "strings" of pollen or using cotton balls.

The pollinator that I use consists of a small peanut butter jar, about 20 feet of copper tubing $\frac{1}{8}$ inch inside diameter, 6 inches of copper tubing $\frac{1}{2}$ inch inside diameter, four feet of $\frac{1}{2}$ " rubber tubing, about 25 feet of 1" aluminum tubing and tape as needed. The top of the jar is perforated with two holes, one to take the $\frac{1}{8}$ " copper tubing and one to take the $\frac{1}{2}$ " copper tubing. The $\frac{1}{2}$ " tubing was carefully bent so that one end of it would reach to the bottom of the jar and the other end passed through the hole made for it and extending at right angles to the jar. It is soldered into place on the jar top. The $\frac{1}{8}$ " copper tubing is inserted into the hole provided for it and secured in place with solder. It is necessary that the two connections around the tubes be airtight and that the top fits tightly on the jar. The $\frac{1}{8}$ " tubing ends just inside the jar top.

The aluminum tube serves merely as a carrier for the $\frac{1}{8}$ " copper tubing, which is taped to it at intervals as necessary. The rubber tubing is slipped over the outside end of the $\frac{1}{2}$ " copper tube. When date pollen is put into the jar, the lid tightened down and the rubber tube blown into, a fog of pollen comes out of the end of the $\frac{1}{8}$ " tube.

I have found it the best policy to go over the date garden at least every other day. If a sheath has broken, I give it a shot of pollen. The next time over, it gets another shot and this can continue until in the opinion of the grower the spathe is too old to take the pollen. If a bunch is missed, the fog of pollen sent up to other bunches is likely to get the job done.

I can pollinate my two acre garden with the blow pollinator in about an hour and a half but if I use cotton balls it takes me nearly two days. I believe that less pollen is used with the blower than with cotton balls.

After pollinating is finished for the year, one trip up a tree will take care of tying the bunches and de-thorning. I estimate that the use of the blower saves me approximately ten trips up the tree a year.

A sketch of the blower is shown in Figure 1.

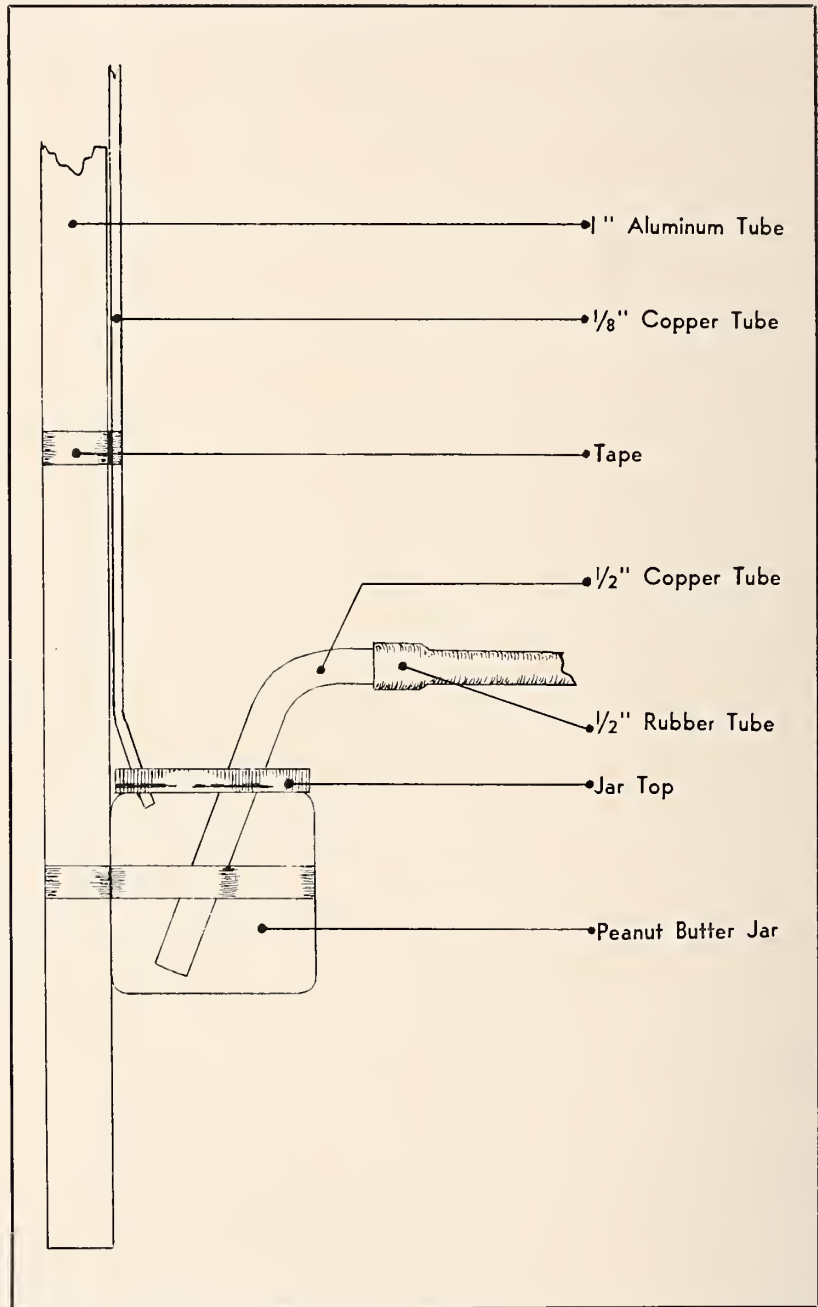


Figure 1. Sketch of D. B. W. Alexander's "Blow Pollinator." Its action is explained in accompanying article.



WALTER TENNYSON SWINGLE (1871-1952)

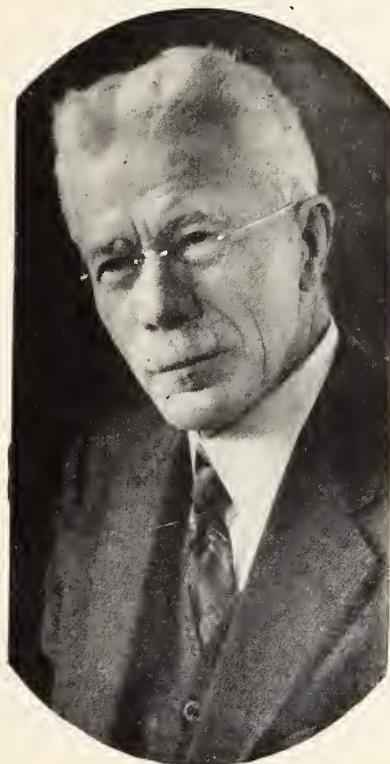
By Roy W. Nixon

U. S. Date Garden, Indio, California

I first met Dr. Walter T. Swingle at the Southern Pacific Railroad station in Ontario, California, about sundown one day in June 1923. He had stopped by to see me about the possibility of my taking a position at the U. S. Date Garden at Indio. I was impressed from the beginning by his enthusiasm for research and his wide and intimate knowledge of plant science. His conversation abounded with personal observations and his fertile imagination and vivid similes enlivened subjects that otherwise might have been dull and drab. Until late that night we talked about research and its opportunities; he told me about some of his travels abroad; and before we parted I had contracted some of his enthusiasm and was looking forward to scientific adventures in the realm of date culture.

This first impression of Dr. Swingle's boundless energy and creative imagination was confirmed by the association of later years. I found that his advice and counsel were often sought by his colleagues in the U. S. Department of Agriculture. In fact, near the turn of the century he played an important part in the creation of the Bureau of Plant Industry and helped to formulate its early policies. In those early years his close associates frequently referred to him as "the Bureau hot bed" or the "Plant Bureau incubator" for new and important ideas in plant work. Few of his colleagues could keep up with his high-gear mental activity. One of his closest friends, the late Dr. H. J. Webber, whose accomplishments in plant science were also outstanding, once told me that after two or three days of continuous association with Dr. Swingle, he (Webber) began to develop mental fatigue. This indefatigable energy and multiplicity of ideas were sometimes a bit exasperating to Dr. Swingle's staff, for it was never possible to carry out all of his suggestions; but he was never unreasonable in his appraisal of accomplishment.

The range of Dr. Swingle's interests was extremely broad. His correspondence was world-wide. When he learned of some new development or discovery in plant science, wherever it might be, he would often immediately write a long letter to the scientist involved and discuss the implications of the discovery, frequently suggesting some new aspect or possibility that might have been overlooked.



Born at Canaan, Wayne County, Pennsylvania, January 8, 1871, Dr. Swingle died in Washington, D. C., January 19, 1952. He was reared on a farm and received his early schooling at home. He attended the Kansas State Agricultural College from which he received the Bachelor of Science degree in 1890, the Master of Science degree in 1896, and the Doctor of Science degree in 1922. Also he studied in Germany at the University of Bonn in 1895-96 and at the University of Leipzig in 1898.

He entered the U. S. Department of Agriculture in 1891 as a special agent of the Division of Vegetable Pathology and until 1897, except for periods of advanced study as noted, he investigated the pathology and cross-breeding of citrus fruit in Florida in association with Dr. H. J. Webber. During this period he made crosses which resulted in several new citrus fruits; among them tangelos, some of which are now grown commercially, and citranges, some of which have been found to have value as stocks.

As an agricultural explorer for the U. S. Department of Agriculture, beginning in 1898, he made many trips to study the agriculture and botany of southern Europe, north Africa, the Near East, China, Japan, and the

Philippines. During his first year as an agricultural explorer he introduced the fig insect (*Blastophaga*) from Algeria into California, thereby rendering possible the successful culture of figs of the Smyrna type. While in Algeria he became interested in the date palms grown there on a large scale. In the spring of 1899 he made an experimental shipment of a half-dozen Deglet Noor offshoots from Algeria to Arizona, but through lack of proper handling they all died after they were planted out.

In 1900 following a visit to Arizona and a conference with Prof. J. W. Toumey, Director of Arizona Agricultural Experiment Station, Dr. Swingle went back to Algeria determined to introduce date culture in the United States. He visited the French plantations in the Oued Rhir of southern Algeria and personally secured a collection of 405 offshoots, most of them of the Deglet Noor and Rhars varieties. These were carefully packed at Algiers and shipped by water to New Orleans and thence by rail to Tempe, Arizona. The offshoots were planted near Tempe, in cooperation with the Arizona Agricultural Experiment Station; because of the special precautions taken in packing, shipping, and handling, most of them survived. This was the first successful importation of superior date varieties true to name.

In 1927 Dr. Swingle went to Morocco and was able to secure offshoots of the Medjool variety, which is now beginning to appear on the markets as a new and promising date for commercial culture.

In addition to the importations which he personally supervised, it should be stated that because of his enthusiasm and vision Dr. Swingle was largely responsible, either directly or indirectly, for all the other experimental importations of date offshoots made by the U. S. Department of Agriculture, including those of Fairchild, Kearney, Mason, and Nixon.

During his sojourn in Algeria, Dr. Swingle had made a careful study of climatic and soil conditions in the districts where the Deglet Noor variety is grown, and upon his return to the United States he made similar studies in southern Arizona and California. The results of these extensive investigations were published in Bulletin 53 of the U. S. Bureau of Plant Industry. This is a comprehensive survey of date culture with a vast amount of data comparing climate, soil, and other ecological factors in

Algeria with those in southern California and Arizona. On the basis of these investigations, Dr. Swingle concluded that in the Salton Basin there were conditions most like those of date-growing districts of the Sahara and hence most likely to be adapted to the growing of the Deglet Noor and other fine varieties.

Under the direction of Dr. Swingle, and in cooperation with the California Agricultural Experiment Station, a date experiment station was established, near Mecca, California, in 1904. This was followed three years later by the establishment, about 2 miles west of Indio, of the U. S. Date Garden, which has been, since that time, the center for date research.

As head of the Office of Crop Physiology and Breeding Investigations, Dr. Swingle was in charge of Federal research not only on dates but also on citrus and other subtropical fruits. He contributed to research in many fields. As a result of his early studies he invented improvements for the microscope and contributed to a better understanding of cell structure in plants. As an agricultural explorer, he introduced many

new crop plants, including alkaloid-yielding species of Ephedra and tung, the source of oil used in varnish. He discovered that old citrus varieties could be rejuvenated by growing nucellar bud seedlings, a procedure which has lately become very important, because in this way many virus infections, such as quick decline, may be eliminated. His outstanding work with citrus was in the field of taxonomic botany, culminating in a complete synopsis of this family under the title of *The Botany of Citrus and Its Wild Relatives*, published in 1943 as a part of Volume 1 of Citrus Industry. He was the author of numerous papers on citrus, dates, and other subtropical plants.

Dr. Swingle retired from the U. S. Department of Agriculture in 1941, but continued his scientific activities as a collaborator of the Department and as a consultant in tropical botany for the University of Miami, Florida.

Dr. Swingle is survived by his widow, Mrs. Maude Kellerman Swingle, two sons — John William and Frank Anthony, and two daughters— Stella (Mrs. Stanley F. Reed) and Mary (Mrs. Francis L. Albert, Jr.).

Dr. Swingle was associated with

Dr. H. J. Webber and farm advisors M. L. Winslow and E. L. Garthwaite in planning the first Date Growers' Institute in 1924 and contributed a number of papers to its programs.* To him must be given a large share of the credit for the establishment of a commercial date industry in the United States.

*Contributions by Dr. W. T. Swingle to the Date Growers' Institute Annual Reports:

1. *Cooperative Quarantine Date Nurseries*. 1:25-26. 1924.
2. *Low temperature dehydration of cane sugar dates*. 1:31-32. 1924.
3. *Pruning the date palm*. 2:12-14. 1925.
4. *Date culture in Southern Morocco*. 6:16-19. 1929.
5. *New Investigations on the correlation between root and leaf growth and the water requirements of the date palm*. 8:7-9. 1931.
6. *Introduction of the Medjool date from Africa into the United States*. 22:15-16. 1945.
7. *First successful introduction of standard varieties into the New World*. 24:21-22. 1947.



Date Growers Institute - 1952 Membership

Arkell Date Gardens Indio
 Blackburn, R. W. Thermal
 Boyce, A. M. Riverside
 Breyer, Alberto . . Buenos Aires, Argentina
 Brown, T. R. Thermal
 Burnett, J. B. Thermal
 California Date Growers Indio
 Capper, Melvin Palm Springs
 Carey, Laura K. Palm Springs
 Carlson, Ted Indio
 Carreon, Dr. R. J. Jr. Indio
 Cavanagh, H. L. Indio
 Citrus Experiment Station Riverside
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 McBean, Kelley Indio
 Mitchell, D. H. Indio
 Mock, D. C. Redlands
 Newcomb, D. A. Thermal
 Nixon, Roy W. Indio
 Page, Milton C. Indio
 Peterson, H. E. Cathedral City
 Pinyan, R. A. Indio
 Reichel, William Oakland
 Reid, Martha D. Rancho Mirage
 Reuther, Walter Orlando, Fla.
 Richardson, H. B. Davis
 Richardson, W. L. Porterville
 Russel, Robbins Redlands
 Ryerson, R. A. Davis
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 Scheniman Paper Co. Indio
 Schroeder, C. A. Los Angeles
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 Shields, E. Floyd Indio
 Smead, Paul Thermal
 Sphinx Date Co. Phoenix, Arizona
 Stafford, N. B. La Quinta
 Staples, A. W. Indio
 Swingle, Leonhardt Indio
 Swingle, Mrs. Walter T. . Washington, D. C.
 Turk, Howard Coachella
 Venus Foods Los Angeles
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